## REMARKS

Claims 1-20 are pending, with claims 1, 7, 14, 15, and 16 being independent.

Applicant's responses to specific rejections are presented below following excerpted text of the May 29, 2007, final Office action, which is presented in bold, single-spaced, 9 point font. The advisory action mailed October 5, 2007, and the decision on the pre-appeal brief conference request mailed December 12, 2007, maintained the rejections of the final Office action without elaboration.

> **2. Claims 2, 8 and 17 are rejected under 35,U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 2, 8 and 17 state that the "continuous time filter is configured to 'pre-distort' the incoming data signal." However, pre-distortion is commonly known in the art as a distortion signal that is applied to a transmitted signal prior to transmission such that the signal compensates inversely with regard to future incurred distortions such as distortion gained by transmission through an optical fiber. It is unclear how an incoming data signal can be "pre-distorted."**

Applicant disagrees. When the claim language is properly read in the context of the entire specification of the application the claim language is not indefinite. In particular, it is clear how an incoming data signal can be "pre-distorted" by the continuous time filter, as recited in the claims.

For example, page 9, lines 21 - 31 and FIG. 4 make clear that the continuous time filter 410 can receive an incoming signal and "pre-distort" the incoming signal before feeding the pre-distorted signal to a decision feedback equalizer. Thus, at least in one embodiment, the "pre-" prefix can refer to an operation that is performed on a signal by the continuous time filter before the signal is received by the decision feedback equalizer (and, for example, after the signal is received by the continuous time filter).

> **4. Claims 1-2, 7-8, 11-12, 14-1 5 and 17 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent Application Publication No. 200410151268 to Hidaka et al.**
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> **With respect to claims 1, 7 and 14-1 5, Hidaka discloses an optical communication device comprising (complete with transmitter 12, communication media 16, and receiver 14, Figure 1): a continuous time filter (page 3 paragraph 24 (continuous time analog filter)) (32, Figure 2) (42, Figure 3) having an adjustable bandwidth, wherein the continuous time filter is configured to reduce channel induced pre-cursor interference in an incoming data signal (page 4 paragraphs 47-48 (adaptation matrix 82 provides parameters for compensating both pre-cursor and post - cursor ISI)) (page 2 paragraph 24 (adjustable filter 32 compensates for distortion in the signal wherein control and adjustment of adjustable filter is provided by adaptation control 39)), and generate a filtered incoming data signal (page 2 paragraph 28 (adjustable filter receives transmitted data sequence a^k after the signal has traveled over channel 42)); and a decision feedback equalizer, coupled to the continuous time filter, and configured to reduce post-cursor interference (page 4 paragraphs 47-48 (adaptation matrix 82 provides parameters for compensating both pre-cursor and post - cursor ISI)) in the**

**filtered incoming data signal (page 2 paragraph 22 (adaptive equalization system provides high-degree equalization to overcome IS1 in the data signal communicated)) and output a compensated signal and equalized data (Signal a^ k in Figure 3) (page 2 paragraph 24 (filter compensates for distortion)) (page 3 paragraph 34 (data sequence passes through equalizer)) and a bandwidth controller (page 2 paragraph 24 (control and adjustment of adjustable filter 32 is provided by adaptation control 39)) (Hidaka: 39, Figure 2) configured to receive the compensated signal from the decision feedback equalizer (feedback from detector 134 is sent to bandwidth control unit 137) and estimate a bandwidth error of the continuous time filter based thereon (136, Figure 4 (error calculator)), the bandwidth controller further configured to generate a control signal based on the bandwidth error (signal from unit 137 is a control signal used to adjust the continuous time filter 132, Figure 4) and to adjust the bandwidth of the continuous time filter (132, Figure 4) using the control signal, and thereby reduce the bandwidth error as determined from the decision feedback equalizer (page 2 paragraph 25 (decision feedback detector provides decision feedback equalization data to bandwidth calculator 38 which is further sent to adjustable filter 32 as a control signal to provide distortion compensation)).**

Applicant disagrees. The claims recite:

1. … "a continuous time filter having an adjustable bandwidth . . . [and] configured to reduce channel induced pre-cursor interference";

"a decision feedback equalizer, coupled to the continuous time filter, and configured to reduce post-cursor interference in the filtered incoming data signal"; and

"a bandwidth controller configured to receive [a] compensated signal from [a] decision feedback equalizer and estimate a bandwidth error of the continuous time filter based thereon, the bandwidth controller further configured to generate a control signal based on the bandwidth error and to adjust the bandwidth of the continuous time filter using the control signal, and thereby reduce the bandwidth error as determined from the decision feedback equalizer.

7. … "a continuous time filter having an adjustable bandwidth, . . . configured to generate a filtered information signal;

a decision feedback equalizer configured to receive the filtered information signal . . . ; and

a bandwidth controller configured . . . to adjust the adjustable bandwidth based thereon . . ."

14. … "bandwidth control means for adjusting the bandwidth of the filter means to reduce channel induced distortion in the received information signal, and

equalizer means coupled to the filter means for reducing inter-symbol interference in the filtered information signal."

15. … "filtering . . . using a first filter bandwidth to obtain a filtered information signal;

equalizing the filtered information signal using a previous symbol of the information signal;

generating a bandwidth error signal from at least the equalized filtered information signal;

adjusting the first filter bandwidth to a second filter bandwidth; and
filtering a next symbol of the information signal with the second filter bandwidth to reduce the bandwidth error signal.

The Office reads Hidaka as disclosing these elements, but, in fact, Hidaka does not disclose or suggest all the elements of independent claims.

First, the Office action states that "Hidaka discloses . . . a continuous time filter (page 3 paragraph 24 (continuous time analog filter)) (32, Figure 2) (42, Figure 3) having an adjustable bandwidth . . .", however, the Office action provides no evidence or support for its assertion that any continuous time filter in Hidaka "ha[s] an adjustable bandwidth," as recited in the claims. Indeed, Hidaka makes no mention of a continuous time filter having an adjustable bandwidth. In fact, Hidaka suggests that the adjustable filter 32 operates as an amplitude filter, rather than a bandwidth filter. See paragraph 0025 ("Error calculator 32 performs signal processing to calculate an error associated with the sampled signal. Such error may comprise an amplitude error.") and paragraph 0044 ("At summation node 70, the sampled signal $\tilde{d}_k$ is subtracted from the expected sampled predetection signal $\hat{d}_k$ to yield an error e_k, which may comprise an amplitude error of the transmitted signal."). At least for this reason, applicant requests that the rejection be withdrawn.

Second, the Office action states that Hidaka discloses "a continuous time filter (page 3 paragraph 24 (continuous time analog filter)) (32, Figure 2) (42, Figure 3) . . . configured to reduce channel induced pre-cursor interference . . . (page 4 paragraphs 47-48 (adaptation matrix 82 provides parameters for compensating both pre-cursor and post - cursor ISl)) (page 2 paragraph 24 (adjustable filter 32 compensates for distortion in the signal wherein control and adjustment of adjustable filter is provided by adaptation control 39)), . . . and a decision feedback equalizer, coupled to the continuous time filter, and configured to reduce post-cursor interference (page 4 paragraphs 47-48 (adaptation matrix 82 provides parameters for compensating both pre-cursor and post - cursor ISI)).

Again, the Office does not state where in Hidaka it believes that a decision feedback equalizer is disclosed, and the Office provides no citation to Hidaka for the purported disclosure of this claim element. However, because the Office action cites the same passage, "page 4 paragraphs 47-48 (adaptation matrix 82 provides parameters for compensating both pre-cursor and post - cursor ISI)," to support both its contention that Hidaka discloses a continuous time filter configured to reduce channel induced pre-cursor ISI and to support its contention that Hidaka discloses a decision feedback equalizer configured to reduce post-cursor ISI, it appears that the Office's position is that the Hidaka's filter (32, Figure 2) (42, Figure 3) is equivalent to both the continuous time filter and the decision feedback equalizer recited in the claims. But claim 1 states that the decision feedback equalizer is "coupled to," and therefore independent from, the continuous time filter (other claims contain language that similarly indicates that separate filters are used for separate filtering operations). The application at page 9, line 21 – page 13, line 29 explains how the separate structure of the continuous time filter and the decision feedback equalizer can operate independently but cooperative to reduce pre-cursor ISI and post-cursor ISI, respectively.

At page 4 of the Office action, the Office argues separately that Hidaka's detector 34 is a decision feedback equalizer, but this argument is inconsistent with the Office's position above that the filter 32 is equivalent both to a continuous time filter and to a decision feedback equalizer. In addition, Hidaka does not disclose that detector 34 reduces post-cursor ISI.

For at least this reason, the applicant requests that the rejection be withdrawn.

Third, the Office action states that Hidaka discloses "a bandwidth controller (page 2 paragraph 24 (control and adjustment of adjustable filter 32 is provided by adaptation control 39)) (Hidaka: 39, Figure 2) configured to . . . adjust the bandwidth of the continuous time filter (132, Figure 4). However, the Office provide no citation to any portion of Hidaka that adaptation control 39 is configured to "adjust the bandwidth" of a continuous time filter as recited in claim 1. Indeed, Hidaka does not disclose or suggest adjusting a bandwidth of a filter. Rather, as explained above, Hidaka suggests only that filter 32 operates as an amplitude filter.

At least for this reason, applicant requests that the rejection be withdrawn.

**With respect to claims 2 and 17 Hidaka discloses the communication device of claim 1 wherein the continuous time filter (page 3 paragraph 24 (continuous time analog filter)) (32, Figure 2) (42, Figure 3) is configured to compensate the incoming data signal, based on the control signal, to thereby improve an operation of the decision feedback equalizer (Hidaka: page 2 paragraph 24 (control and adjustment of adjustable filter 32 is provided by adaptation control 39)) (Hidaka: 39, Figure 2) (Hidaka: 38, Figure 2 (error calculator)) (Hidaka: page 2 paragraph 28 (adjustable filter receives a control signal for adjustment of filter coefficients)) (Hidaka: page 3 paragraph 32 (calculation of error ei is used to adjust subsequent signals passing through adjustable filter 44 to compensate for distortion)).**

**With respect to claim 8, Hidaka discloses the receiver of claim 7, wherein the bandwidth controller (page 2 paragraph 24 (control and adjustment of adjustable filter 32 is provided by adaptation control 39)) (Hidaka: 39, Figure 2) is configured to estimate a bandwidth error (page 3 paragraph 33 (error is calculated to adjust compensation of the filter)) of the continuous time filter (44, Figure 4) based on the compensated signal (signal exiting detector 48, Figure 4), and to adjust the adjustable bandwidth of the continuous time filter to reduce the bandwidth error (page 3 paragraph 33 (calculation of the error is used to adjust the adjustable filter to compensate for distortion)).**

Applicant disagrees. Claims 2, 8, and 17 are dependent claims that depend from allowable independent claims and therefore are allowable at least for the reasons that their base claims are allowable.

In addition, claims 2 and 17 recite that the "continuous time filter is configured to pre-distort the incoming data signal, based on the control signal, to thereby improve an operation of the decision feedback equalizer." However, the Office action does not contend that this is disclosed by Hidaka, but only that Hidaka's filter 32 "compensate" the incoming signal and furthermore does not provide any evidence that this compensated signal is used in Hidaka to improve an operation of the separate decision feedback equalizer.

**6. Claims 3, 9 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Application Publication No. 200410151268 to Hidaka et al. in view of U.S. Patent No. 5,179,302 to Wagner et al. With respect to claims 3, 9 and 16 Hidaka discloses the communication device of claim 1, however fails to specifically disclose the continuous time filter comprises at least one cascaded low pass filter. However, adjustable filters comprising at least one cascaded low pass filter is are known in the art and cannot be considered a patentable limitation. Wagner, from the same field of endeavor discloses a tunable filter (title, tunable data filter) wherein the filter includes cascaded filters wherein the cascaded filter comprises at least one low pass filter (page 2 lines 64-67 (notch filter and low-pass filter are cascaded serially)). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to implement the cascaded low-pass filter as taught by Wagner into the adjustable filter arrangement as taught by Hidaka. The motivation for doing so would have been to reduce bit error rate and noise bandwidth (column 5 lines 53-58). Furthermore, it is known that cascading arrangements approximate which make up higher order transfer functions possess a greater degree of signal quality than a single filter with the same higher order transfer function characteristics.**

Applicant disagrees. Claims 3 and 9 are dependent claims that depend from allowable independent claims and therefore are allowable at least for the reasons that their base claims are allowable.

Claims 16 recites:

> ". . . a continuous time filter having at least one cascaded low pass filter, each of the at least one cascaded low pass filter having an adjustable bandwidth . . . ;
> a decision feedback equalizer, coupled to the continuous time filter, and configured to reduce post-cursor interference in the filtered incoming data signal and output a compensated signal; and
> a bandwidth controller configured to . . . adjust the bandwidth of the at least one cascaded low pass filter using the control signal, and thereby reduce the bandwidth error as determined from the decision feedback equalizer."

Thus, because claim 16, contains subject matter similar to that of claim 1, claim 16 is allowable at least of the reasons that claim 1 is allowable.

> **7. Claims 4,10 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over U .S. Patent Application Publication No. 2004101 51 268 to Hidaka et al. in view of U.S. Patent No. 5,179,302 to Wagner et al. and further in view of U.S. Patent No. 6,968,167 to Wu et al.**
>
> **With respect to claims 4,10 and 18 Hidaka in view of Wagner disclose the communication device of claim 3 wherein each of the at least one low pass filter (Wagner: 90, Figure 3) comprises adjustable capacitive loads coupled to outputs of the differential pair of transistors for adjusting the bandwidth of the low pass filter (Wagner: capacitor 42C is used to tune low pass filter 90) (Wagner: columns 3 lines 1-13 (voltage tunable capacitors coupled to the low-pass filter)). However, Hidaka in view of Wagner fail to specifically disclose a differential of transistors for used for adjusting bandwidth Despite this differential transistor pairs used for bandwidth alteration is well known in the art. Wu, from the same field of endeavor discloses a differential transistor pair arrangement (Figure 4 (a)) substantially similar to the one as disclosed by applicant in applicants specification, Figure 6. Wu teaches calibration of the capacitors (column 43 lines 4-14) and the filter arrangement with a control word (column 18 lines 1-3 and 17- 30) (Figure 12a) (column 43 lines 37-46). Wu further teaches an RC low-pass filter (column 44 line 27) can be controlled using a parallel capacitor array ((column 44 lines 52-56). Therefore, it would have been obvious to one of ordinary skill in the art to implement the differential pair of transistors with capacitance control as disclosed by Wu. The motivation for doing so would have been to achieve greater adaptivity (column 18 lines 1-2) and also to provide frequency planning, agility, and noise immunity (column 13 lines 35-40).**

Applicant disagrees. Claims 4, 10, and 18 are dependent claims that depend from allowable independent claims and therefore are allowable at least for the reasons that their base claims are allowable.

> **8. Claims 5,11 and 19 rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Application Publication No. 2004101 51268 to Hidaka et al. in view of U.S. Patent No. 6,144,697 to Gelfand et al.**

**With respect to claims 5, 11 and 19 Hidaka discloses the communication device of claim 2, wherein the decision feedback equalizer comprises a summer (55, Figure 3) (70, Figure 5) (116, Figure 7). However, Hidaka fails to disclose the summer is configured to generate the compensated signal. However, such an arrangement is well known in the art. Gelfand, from the same field of endeavor discloses an equalization technique to reduce IS1 (title) wherein the output of the summer (64, Figure 2) configured to generate the compensated signal (65, Figure 2) by combining an equalized feedback signal (89, figure 2) with the filtered incoming data signal (79, Figure 2). Therefore, it would have been obvious to one of ordinary skill in the art to implement the specific feedback implementation as disclosed by Gelfand into the system as disclosed by Hidaka. The motivation for doing so would have been to facilitate the removal of inter-symbol interference from sparse signal portions before sparseness is potentially diminished by other equalization procedures (Gelfand: column 2 lines 25-30). Furthermore, the setup as taught by Gelfand advantageously reduces multiplication operations and more efficiently uses limited multiplier resources (Gelfand: column 2 lines 30-34).**

Applicant disagrees. Claims 5, 11, and 19 are dependent claims that depend from allowable independent claims and therefore are allowable at least for the reasons that their base claims are allowable.

**9. Claim 13 is rejected under 35 U.S.C.103(a) as being unpatentable over U.S. Patent Application Publication No. 200410151268 to Hidaka et al. in view of U.S. Patent Application Publication No. 200510019042 to Kaneda et al.**

**With respect to claim 13, Hidaka discloses the communication system of claim 7, however does not describe specifics of optical communication. Kaneda, from the same field of endeavor discloses a receiver (Figure 4) further comprising an optical detector for converting the received information signal to an electrical signal (page 1 paragraph 4 (optical receiver includes a photo-detector for converting a received optical signal to an electrical signal)). Therefore, it would have been obvious to one of ordinary skill in the art to implement the optical communication element3 as disclosed by Kaneda into the transmission system as disclosed by Hidaka. The motivation for doing so would have been to keep pace with increasing bandwidth demands (Kaneda: page 1 paragraph 2).**

Applicant disagrees. Claim 13 is a dependent claim that depends from an allowable independent claim and therefore is allowable at least for the reasons that its base claims is allowable.

## ALLOWABLE SUBJECT MATTER

**10. Claims 6, 12 and 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.**

Applicant appreciates the Examiner's indication of allowability regarding claims 6, 12, and 20. Applicant will address these claims when the outstanding rejections of claims 1, 7, 14, 15, and 16 have been resolved.

*Conclusion*

Applicant believes that all pending claims are in condition for allowance and respectfully requests notification to that effect. The Examiner may telephone Applicant's attorney (202-470-6453) to facilitate prosecution of this application.

According to the decision on the pre-appeal brief conference request mailed December 12, 2007, this response is due by January 12, 2007. Thus, no fees are believed to be due at this time. If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 50-3521, referencing Attorney Docket No. BU3393/0033-095001.

Respectfully submitted,

Brake Hughes Bellermann LLP
**Customer No. 57246**
Phone 202-470-6453

Date: January 11, 2008 By: Mark Bellermann

Mark R.W. Bellermann
Reg. No. 47,419